

II B.Tech I Semester Regular Examinations, November 2006  
ADVANCED DATA STRUCTURE  
( Common to Computer Science & Engineering and Electronics &  
Computer Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
All Questions carry equal marks

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1. (a) What is a local class? Why can it be useful?  
(b) Can a copy constructor accept an object of the same class as parameter, instead of reference of the object?  
(c) What is a class? What is an object?  
(d) What is encapsulation? [4+4+4+4]
2. (a) When should my destructor be virtual?  
(b) What is a “virtual constructor”?  
(c) What’s the difference between how virtual and non-virtual member functions are called? [5+5+6]
3. (a) Explain about try, catch, throw keywords in C++?  
(b) Write a program to illustrate the exception handling mechanism in C++. [8+8]
4. Develop a C++ class `twoStacks` in which a single array is used to represent two stacks. Put the bottom of one stack at one end of array and bottom of second stack at the other end. The two stacks grow towards middle of the array. The class should contain the methods to perform all operations of stack ADT. [16]
5. (a) Explain about the skip list representation of dictionary with an example?  
(b) What are the data members of *skipList* class? Write the constructor for *skipList*. [8+8]
6. Define a class called **binarySearchTree** to represent a Binary search tree. Extend this class by adding a public method **outputInRange (Low,High)** that outputs, in ascending order of key, all elements in a binary search tree whose key lies between Low and High. Use recursion and avoid entering sub trees that cannot possibly contain any elements with keys in desired range. [16]
7. (a) Describe the B-trees? Explain the advantages of B-trees.  
(b) Prove that let T be a red black tree with n internal nodes then no node has depth greater than  $2 \log(n+1)$ . [8+8]
8. (a) Write an algorithm of suffix tire ? compute the performance of an algorithm.  
(b) What are the properties of compressed trie. [10+6]

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1. (a) Explain about the dynamic memory allocation and de-allocation in C++.  
(b) Explain about static inner classes with a program. [8+8]
2. (a) Explain about the Virtual functions in C++?  
(b) Explain about the abstract classes in C++? [8+8]
3. (a) How can we write/read objects of my class to/from a data file?  
(b) How can we send objects of my class to another computer (e.g., via a socket, TCP/IP, FTP, email, a wireless link, etc.)?  
(c) Why can't we open a file in a different directory such as "..\test.dat"?  
(d) How can we tell {if a key, which key} was pressed before the user presses the ENTER key? [4+4+4+4]
4. (a) What is a Sparse Matrix? Explain about the linear list representation of a sparse matrix?  
(b) Write a C++ program to implement multiplication of two sparse matrices represented using an array linear list? [8+8]
5. Use linear probing, a hash table with  $b=17$  buckets, and the hash function  $f(k) = k \% b$ ; Start with an empty hash table and insert pairs whose keys are 7, 42, 25, 70, 14, 38, 8, 21, 34, 11. The pairs are inserted in this order.  
  
(a) Draw the hash table for each insertion?  
(b) What is the loading factor after last insertion?  
(c) What is the maximum number of buckets examined in an unsuccessful search of your table?  
(d) What is the maximum number of buckets examined in a successful search? [4+4+4+4]
6. Define a Red-Black tree? Write the procedures to perform insertion, deletion in a Red-Black tree? [16]
7. (a) Describe the B-trees? Explain the advantages of B-trees.  
(b) Prove that let T be a red black tree with n internal nodes then no node has depth greater than  $2 \log(n+1)$ . [8+8]

8. (a) Explain the boyar Moore algorithm with an example
- (b) What are the advantages and disadvantages of tries with respect to binary search tree. [10+6]

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1. (a) What is Object Oriented paradigm?  
(b) Explain about OOP's principles in detail? [8+8]
2. What is operator overloading? Explain how to overload the operators in C++ by taking any five operators. [16]
3. (a) Write a program to change the case of each word in a file to initial capitals.  
(b) Write a program to concatenate the two given strings? [8+8]
4. Define the Abstract data type for Stack. Write a C++ program to implement stack ADT using arrays. [16]
5. Develop a class for hash table using linear probing and neverUsed concept to handle an erase operation. Write complete C++ code for all the methods. Include a method to reorganize the table when (say) 60% of the empty buckets have never used equal to false. The reorganization should move pairs around as necessary and leave a properly configured hash table in which neverUsed is true for every empty bucket. [16]
6. (a) What is an AVL search tree? How do we define the height of it? Explain about the *balance factor* associated with a node of an AVL tree.  
(b) Explain how an AVL tree can be used to sort a sequence of n elements in  $O(n \log n)$  time. [8+8]
7. (a) Prove that net T be a B-tree of order m and height h. Let  $d = \lceil m/2 \rceil$  and let n be the number of elements in T.
  - i.  $2d^{h-1} - 1 \leq n \leq m^n - 1$
  - ii.  $\log_m(n+1) \leq h \leq \log_d\left(\frac{n+1}{2}\right) + 1$  
(b) Explain the advantages of splay tree in representation of dictionaries. [10+6]
8. (a) Explain the brute force algorithm with an example  
(b) Draw the compact representation of the suffix tree for the string "minimize minima". [8+8]

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1. (a) What is a class? How do you define class in C++?  
(b) Explain about the data members and member functions of a class?  
(c) Explain about access control mechanism in C++? [5+5+6]
2. (a) What is multiple inheritance? Write a program to illustrate the concept of Multiple Inheritance.  
(b) What is Hybrid inheritance? Write a program to illustrate the concept of Hybrid Inheritance. [8+8]
3. (a) Write a program that reverses the order of the characters in a string.  
(b) A palindrome is a word or group of words that read the same forward and backward. For example “madam” or “wow.” Write a program that takes a string argument from the command line and prints whether the string was a palindrome or not. [8+8]
4. Write a method in C++ to join two doubly linked lists into a single doubly linked list. In a join the elements of second list are appended to the end of first list. [16]
5. Use linear probing, a hash table with  $b=17$  buckets, and the hash function  $f(k) = k \% b$ ; Start with an empty hash table and insert pairs whose keys are 7, 42, 25, 70, 14, 38, 8, 21, 34, 11. The pairs are inserted in this order.
  - (a) Draw the hash table for each insertion?
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6. Define a class called **binarySearchTree** to represent a Binary search tree. Extend this class by adding a public method **outputInRange (Low,High)** that outputs, in ascending order of key, all elements in a binary search tree whose key lies between Low and High. Use recursion and avoid entering sub trees that cannot possibly contain any elements with keys in desired range. [16]
7. (a) Write an algorithm of Red-Black tree insertion.

- (b) Explain the operation of splay trees with an example. [8+8]
8. (a) Explain the construction of the kmp flow chart with an example.
- (b) Explain the search engines. [10+6]

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